

REMARKS / ARGUMENTS

Disposition of the Claims

Claims 20 to 22, 24 to 28 and 30 to 31, as amended, and newly added claim 32 are pending in the present application. Applicants respectfully request continued examination of these claims and allowance of all pending claims.

Amendments to the Claims

Claim 17 has been cancelled. Claim 30 has been amended to indicate that the cooling gas mixture consists essentially of a) one or a plurality of infrared radiation absorbing gases selected from the group consisting of saturated hydrocarbons, unsaturated hydrocarbons, CO₂, CO, H₂O, NH₃, NO, N₂O, NO₂ and mixtures thereof and b) optionally an additive gas that comprises at least one member selected from the group consisting of helium, hydrogen and mixtures thereof. Claim 31 has been amended to indicate that the cooling gas mixture consists essentially of a) a content of from about 5% to about 80% by volume of one or a plurality of infrared radiation absorbing gases selected from the group consisting of saturated hydrocarbons, unsaturated hydrocarbons, CO₂, CO, H₂O, NH₃, NO, N₂O, NO₂ and mixtures thereof and b) optionally an additive gas that comprises at least one member selected from the group consisting of helium, hydrogen and mixtures thereof in order to improve the heat transfer to the part by combining radiative and convective heat transfer phenomena and to improve the convective heat transfer coefficient in comparison with conventional conditions of cooling under nitrogen.

First 35 U.S.C. § 103(a) Rejection

In the Final Office Action, the Examiner rejected claims 17, 21 to 22, 24 to 25 and 30 to 32 under 35 U.S.C. § 103(a) as being unpatentable over Stratton et al., US Patent No. 7,147,732 (hereinafter "Stratton '732"). This rejection is respectfully traversed with regard to claims 21 to 22, 24 to 25 and 30 to 32, as amended.

Applicants maintain that claims 21 to 22, 24 to 25 and 30 to 32, as amended, are patentable over Stratton '732 since Stratton '732 teaches against the present invention --

Stratton '732 teaches that the quenching composition used in the method of Stratton '732 requires nitrogen. Stratton '732 teaches a method of quenching a hot metal object using a hot gas stream comprising at least 20% by volume of hydrogen. In addition, the hot gas may contain from 40 to 60% by volume of nitrogen, from 12 to 20% by volume of carbon monoxide, with smaller amounts of other gases such as methane, water vapour, and carbon dioxide typically also being present." Accordingly, Stratton '732 teaches mixtures of hydrogen, nitrogen, and carbon monoxide with small amounts of methane, water vapour and carbon dioxide.

Claim 30 of the present invention provides a method for rapidly cooling metal parts using a pressurized cooling gas mixture that "consists essentially of" one or a plurality of gases selected from the group consisting of saturated hydrocarbons, unsaturated hydrocarbons, CO₂, CO, H₂O, NH₃, NO, N₂O, NO₂ and mixtures thereof and optionally an additive gas selected from the group consisting of hydrogen, helium and mixtures thereof. Claim 31 provides a method for rapidly cooling metal parts using a pressurized cooling gas mixture that "consists essentially of" from about 5% to about 80% by volume of one or a plurality of gases selected from the group consisting of saturated hydrocarbons, unsaturated hydrocarbons, CO₂, CO, H₂O, NH₃, NO, N₂O, NO₂ and mixtures thereof and optionally an additive gas that comprises at least one member selected from the group consisting of helium, hydrogen and mixtures thereof.

The methods of the present invention utilize a cooling gas mixture that must contain one or more of saturated hydrocarbons, unsaturated hydrocarbons, CO₂, CO, H₂O, NH₃, NO, N₂O, NO₂. Unlike Stratton '732, the actual use of hydrogen in the mixture of the present invention is optional. Stratton '732 teaches mixtures that comprise hydrogen, nitrogen and carbon monoxide. While the present invention utilizes hydrogen and carbon monoxide, neither of the methods of the present invention include nitrogen which is required for the mixtures of Stratton '732.

The mixture of Stratton '732 requires the inclusion of nitrogen for quenching. As noted above, the present invention does not require nitrogen. In fact, it is noted in the background of the present invention that "the gas most commonly used for cooling is nitrogen, because it is an inert and inexpensive gas". The background goes on to provide that "it is known, in gas hardening systems, that the temperature must be lowered as rapidly as possible for the steel transformation to occur satisfactorily, from the austenitic phase to the martensitic phase without passing through the pearlitic and/or bainitic phases...[h]owever, it has been observed that in certain critical cases, nitrogen quench hardening installations are not suitable for obtaining a sufficient temperature lowering rate." Accordingly, for these reasons, the present methods do not include nitrogen.

Applicants maintain that Stratton '732 actually teaches away from the present invention since Stratton '732 teaches that nitrogen should be used in the solution utilized for quenching a hot metal object. Applicants maintain that Stratton '732 is simply another example of a document that uses an endothermic gas or a recycled carburizing gas as a quenching gas.

As the mixtures of Stratton '732 require nitrogen and the present invention does not utilize nitrogen, Applicants maintain that claims 21 to 22, 24 to 25 and 30 to 32, as amended, are not rendered obvious by Stratton '732. Accordingly, Applicants respectfully request that the rejection of these claims under 35 U.S.C. § 103(a) as being unpatentable over Stratton '732 be withdrawn.

Second 35 U.S.C. § 103(a) Rejection

In the Final Office Action, the Examiner rejected claim 20 under 35 U.S.C. § 103(a) as being unpatentable over Stratton in view of Nakamura, JP Patent No. 63149313 (hereinafter "Nakamura"). This rejection is respectfully traversed.

Claim 20 depends upon claim 30. Accordingly, the same arguments made with regard to claim 30 are applicable to the rejection of claim 20. The secondary reference cited by the

Examiner, Nakamura, does not overcome the deficiencies of Stratton '732. Accordingly, Applicants maintain that claim 20 is patentable over Stratton '732 in view of Nakamura. Accordingly, Applicants respectfully request that the rejection of this claim under 35 U.S.C. § 103(a) as being unpatentable over Stratton '732 in view of Nakamura be withdrawn.

Third 35 U.S.C. § 103(a) Rejection

In the Final Office Action, the Examiner rejected claims 26 and 27 under 35 U.S.C. § 103(a) as being unpatentable over Stratton in view of Wandke, EP Patent No. 0869189 (hereinafter "Wandke"). This rejection is respectfully traversed.

Claims 26 and 27 depend upon claim 30. Accordingly, the same arguments made with regard to claim 30 are applicable to the rejection of claims 26 and 27. The secondary reference cited by the Examiner, Wandke, does not overcome the deficiencies of Stratton '732. Accordingly, Applicants maintain that claims 26 and 27 are patentable over Stratton '732 in view of Wandke. Accordingly, Applicants respectfully request that the rejection of these claims under 35 U.S.C. § 103(a) as being unpatentable over Stratton '732 in view of Wandke be withdrawn.

Fourth 35 U.S.C. § 103(a) Rejection


In the Final Office Action, the Examiner rejected claim 28 under 35 U.S.C. § 103(a) as being unpatentable over Stratton in view of Andersson, U.S. Patent No. 5,938,866 (hereinafter "Andersson"). This rejection is respectfully traversed.

Claim 28 depends upon claim 30. Accordingly, the same arguments made with regard to claim 30 are applicable to the rejection of claim 28. The secondary reference cited by the Examiner, Andersson, does not overcome the deficiencies of Stratton '732. Accordingly, Applicants maintain that claim 28 is patentable over Stratton '732 in view of Andersson. Accordingly, Applicants respectfully request that the rejection of this claim under 35 U.S.C. § 103(a) as being unpatentable over Stratton '732 in view of Andersson be withdrawn.

CONCLUSION

In view of the above, Applicants maintain that the pending claims are now in condition for allowance. Early notice to this effect is earnestly solicited. Should the Examiner believe a telephone call would expedite the prosecution of the present application, the Examiner is invited to call the undersigned attorney at the number listed below.

Respectfully submitted,


Donna Blalock/Holguin
Registration No. 38,082

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Air Liquide US, LLC
Intellectual Property Department
2700 Post Oak Blvd., Suite 1800
Houston, Texas 77056
Phone: (713) 624-8997
Fax: (713) 624-8950